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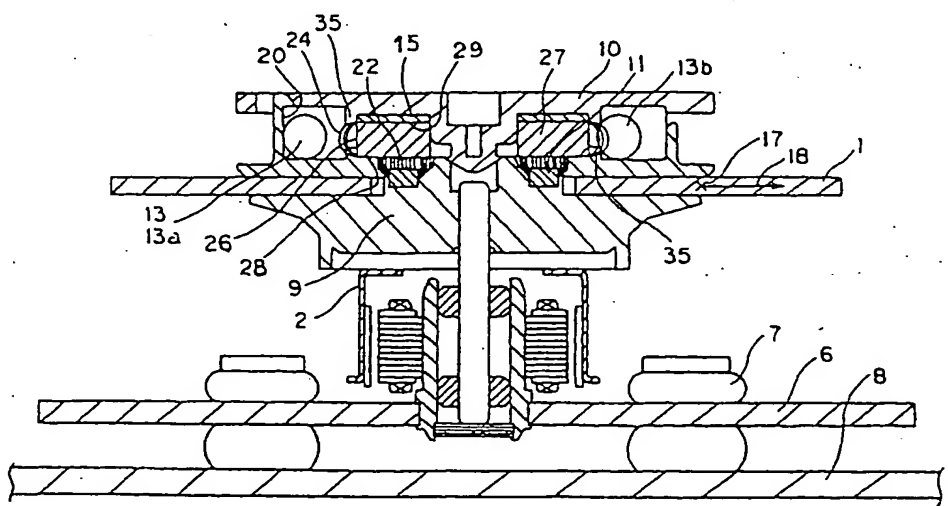
(54) Title: DISK APPARATUS



(57) Abstract

The present invention provides a disk apparatus which can stably suppress the self-vibration, as caused by the unbalance of the disk, during the high-speed rotation, and prevent unnecessary noises from occuring or get rid of factors to induce errors, such as read errors, during the rapid shifting of the number of rotations. This disk apparatus comprises: a balancer, which is set to rotate in one body with a fitted disk (1) and has a hollow ring-shaped part containing a magnetic matter (13); and a magnetic-field-generating means for holding the magnetic matter (13) by suction; wherein the magnetic-field-generating means includes a magnet (27), of which the outer periphery is an inner wall of the hollow ring-shaped part. This disk apparatus further comprises an obstacle means, such as a rib (35), for preventing the magnetic matter (13) from directly contacting the magnet (27), or further comprises a guide groove in a globe-moving face, whereby it is possible to prevent unnecessary noises from occuring, and reduce the impact during the collision of the magnetic globes (13), and further prevent the magnetization operation of the magnet (27) upon the magnetic globes (13).

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DESCRIPTION

Disk Apparatus

TECHNICAL FIELD

The present invention relates to a disk apparatus which has a vibration-suppressing unit for suppressing the self-vibration due to unbalance of a disk as a recording medium, and enables stable recording and replaying.

BACKGROUND ART

In recent years, the data-transferring speed of disk apparatuses, which record and replay data, such as CD-ROM drives and CD-R drives, is getting faster and faster. The high-speed data transferring needs high-speed disk rotation. Many of conventional disks are unbalanced disks which have a bias in mass balance due to factors such as their thickness unevenness. The rotation of such disks at a high speed has problems, for examples, as follows: the self-vibration of the disks is caused by their unbalance force and transmitted to the whole apparatus, so the data cannot stably be replayed, or the vibration make noises or shorten the span of life of the motor, and further, when there is a drive unit inside a computer, the vibration is transmitted to peripheral instruments to give bad influences to them. Therefore, the high-speed data transferring by the high-speed disk rotation needs the suppression of the self-vibration due to unbalance of the disk. Thus, various measures are taken to cancel the unbalance.

Hereinafter, an explanation is made on a conventional disk apparatus which has a function to cancel the unbalance.

Fig. 4 is a perspective of a disk apparatus as provided with a balancer to cancel the unbalance. The number "1" symbolizes a disk, which is placed on a turn table 9 and rotarily driven with a spindle motor 2. A light-pickup 3 reads data as recorded on the disk 1, or writes data onto the disk 1. The rotation of a light-pickup driving motor 4 is converted into a linear movement by function of a light-pickup driving system 5, whereby the light-pickup 3 is frictionally moved in a radial direction of the disk 1. These mechanical systems above are all mounted on a subbase 6, which is connected to a main base 8 through an elastic insulator 7 of low stiffness wherein the insulator 7 attenuates the vibration as transmitted from outside. The disk 1 is rotated by being interposed between the turn table 9 and a clamper 10, both of which rotate in one body with the spindle motor 2. The resonance frequency of the vibration of the subbase 6 due to the deformation of the insulator 7 during the high-speed rotation of the disk 1 is set to lower than the frequency of the high-speed rotation of the disk 1.

Fig. 5 is a section of the vicinity of the spindle motor 2, showing details of a balancer as fitted in one body with the clamper 10 of the above disk apparatus. A yoke 11, which is a magnetic matter and is made of a metal, is fixed on the turn table 9 so as to be rotated in one body with the spindle motor 2. The clamper 10 contains a magnet 27, and the disk 1 is interposed by magnetic adsorbing force of magnetic flux, as generated between the magnet 27 and the yoke 11, so that the disk 1 can be rotated in one body therewith. Usually, the magnetized face 28 of the magnet 27 is magnetized in dipole in view of both the easiness in the production process and the simple usage. The number "15" is a back yoke of a metallic magnetic matter and is fixed by adsorption onto an

unmagnetized face 29 of the magnet 27 to intercept magnetic flux as leaked from other than the magnetized face 28, thus enhancing the efficiency of the sucking force to the disk 1. The clamper 10 contains at least two magnetic globes 13 possible to tumble. The numbers "13a" and "13b" symbolize positions of the globes 13 during the high-speed rotation and during the low-speed rotation respectively, being shown separately into right and left portions of the drawing figure. These balancer-constituting parts are mounted on the subbase 6, which is connected to the main base 8 through the insulator 7. As is aforementioned, the resonance frequency of the vibration of the subbase 6 due to the deformation of the insulator 7 during the high-speed rotation of the disk 1 is set to lower than the frequency of the high-speed rotation of the disk 1.

Fig. 6 is a view showing that the unbalance is canceled during the high-speed rotation of the disk by the movements of the globes 13 as provided inside the clamper 10, and this fig. is a section of the clamper 10 as viewed from upward.

Referring to Fig. 5 and Fig. 6, explanations are made about the condition of the globes 13 during the low-speed rotation of the unbalanced disk 1, and about the cancellation of the unbalance of the disk 1 during the high-speed rotation thereof.

As to the CD-ROM drive, the disk 1 is usually rotated at a high speed (about 4,200 rpm at maximum in the 8-time speed mode) to achieve a fast data-transferring speed when reading data. On the other hand, for example, as to the audio play, the disk is usually rotated at a standard speed (about 200~500 rpm). Thus, there coexist the high-speed rotation area, such as data read, and the low-speed rotation area, such as audio

play.

When the disk 1 with unbalance is rotated on its own axis at a high speed, the unbalance force 18 that is the centrifugal force operates upon the gravity center 17 of the disk 1, and its operating direction rotates along with the disk 1. This unbalance force 18 deforms the insulator 7 to cause the subbase 6 to rotate while swinging at a rotational frequency of the disk 1. Because, as is aforementioned, the resonance frequency of the vibration of the subbase 6 is set to lower than the rotational frequency of the disk 1, the direction of the displacement of the subbase 6 is always opposite to the direction of the unbalance force. Therefore, upon the at least two globes 13 as provided inside the clamper 10 so as to be tumbled, there operates the movement force 22 that is the resultant of the centrifugal force 19 with the resistant force 21 from a tumbling face 20 where the globes 13 are pressed to be tumbled. As a result, the globes 13 moves in a direction getting away from the swinging-rotation center 23, and assemble in a direction opposite to the direction of the unbalance force 18, and finally, the amount of the unbalance of the disk 1 is canceled owing to the total mass of the assembled globes 13a.

On the other hand, in the low-speed rotation area such as standard speed, the centrifugal force 19 of the globes 13 is so insufficient that the globes 13 are not pressed to the tumbling face 20, and the placing of the globes 13 therefore becomes unstable, thus making unnecessary noises, such as tumbling sounds of the globes 13, frictional movement sounds between the globe 13 and an inner-face part of the clamper 10, and sounds of collision between the globes 13. To prevent them, the globes 13 are made of metallic magnetic matters. Furthermore, the leaked magnetic flux 24 of the magnet 27, or the magnetic flux 25 from the magnetized face

28 to the back yoke 15, is utilized to allow the outer periphery 26 of the magnet 27 or the back yoke 15 to directly adsorb the globes 13 to stabilize their placing in the positions of the globes 13b, thus preventing the occurrence of the above unnecessary noises.

However, the above constitution has the below-mentioned problems when the rotation of the disk 1 is rapidly shifted from the high-speed rotation to the low-speed rotation.

As to some of CD-ROM disks, generally, there coexist data and audio in a disk. When such a disk is replayed, there occurs a pattern in which just after reading data at a high speed, the number of rotations is dropped to the standard one to replay the audio. That is to say, the disk is rapidly shifted to a low speed when being rotated at a high speed, and just thereafter, the audio play must be carried out.

As is aforementioned, during the high speed, the globes 13 are rotated in one body with the clamper 10 while being pressed to the tumbling face 20 to cancel the unbalance of the disk 1. However, when the number of rotations drops to a predetermined one, the centrifugal force to operate upon the globes 13 is so insufficient that the globes 13 are adsorbed by the outer periphery 26 of the magnet 27 or by the back yoke 15 due to the function of the leaked magnetic flux 24 of the magnet 27 or the function of the magnetic flux 25 from the magnetized face 28 to the back yoke 15. However, as is aforementioned, the magnetized face 28 of the magnet 27 are magnetized in dipole. In the case of this dipole magnetization, there are characteristics in that the leaked magnetic flux 24 is large, while the magnetic flux density of the magnetic flux 25 is small. Therefore, when the disk 1 is shifted from the low-speed rotation to the high-speed rotation, the globes 13 are difficult to separate from the

outer periphery 26 of the magnet 27. Inversely, when the disk 1 is shifted from the high-speed rotation to the low-speed rotation, the outer periphery 26 of the magnet 27 is difficult to adsorb the globes 13, because the globes 13 do not separate from the tumbling face 20 unless the centrifugal force 19 to operate upon the globes 13 becomes considerably small. When, as is aforementioned, the disk is shifted to the audio play just after reading data by high-speed rotation, the globes 13 are adsorbed by the outer periphery 26 of the magnet 27 after the initiation of the audio data reading, because of the above characteristics of the difficulty in separation and adsorption of the globes 13. The impact during this adsorption is transmitted to the disk 1, thus causing the induction of read errors.

In addition, as is shown in Fig. 6, when the own weight of the globe 13 is larger than the centrifugal force 19, operating upon it, in the low-speed rotation area in the case of using the disk apparatus in a perpendicular attitude, the clamper 10 in Fig. 5 is rotated in a state where the globes 13 are adsorbed by the outer peripheral portion of the magnet 27, so there occurs the unnecessary noises, as is shown in Fig. 6, such as tumbling sounds of the globes 13 and sounds of collision between the globes 13, thus damaging the quality of goods.

DISCLOSURE OF THE INVENTION

OBJECT OF THE INVENTION

Considering the above-mentioned problems, an object of the present invention is to provide, in a disk apparatus which has the aforementioned balancer mechanism, an improvement wherein, during the high-speed rotation or during the rapid shifting of the number of rotations or even in the case of using the disk apparatus in a

perpendicular attitude, the placing of the globes is stabilized to facilitate the movement of the globes, thus inhibiting the occurrence of unnecessary noises or the occurrence of errors during the spinning up from being induced.

SUMMARY OF THE INVENTION

To solve the above problems, a disk apparatus according to the present invention comprises: a balancer, which is set to rotate in one body with a fitted disk and has a hollow ring-shaped part containing a magnetic matter; and a magnetic-field-generating means for holding the magnetic matter by suction. This disk apparatus further comprises at least one of the following constitutions (a) and (b):

(a) that: the magnetic-field-generating means includes a magnet, and the outer periphery of the magnet is an inner wall of the hollow ring-shaped part, and the disk apparatus further comprises an obstacle means for preventing the magnetic matter from directly contacting the magnet;

(b) that the disk apparatus further comprises a guide groove for guiding the movement of the magnetic matter in a lower face of the hollow ring-shaped part.

The inclusion of the above constitution (a) or (b) reduces the impact as given by the collision of the magnetic globes with the tumbling face or the vicinity of the outer periphery of the magnet during the spinning-up or the rapid shifting of the number of rotations of the disk.

Even if the initiation of the audio data reading overlaps with the impact due to the collision of the globes when the high-speed rotation is rapidly shifted to the standard-speed audio play in the disk apparatus involving the use of the magnetic globes as the means of canceling the unbalance force of the disk, the impact due to the collision of the globes is

reduced by the aforementioned obstacle means or guide groove, so the induction of errors such as read errors can be prevented to carry out stable replay.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, some of the embodiments of the present invention are explained while referring to the drawings. Incidentally, as to the constitution of the embodiments of Figs. 1~3, the same components as those of the conventional apparatuses of Figs. 4~6 are given the same numbers as those for the conventional apparatuses.

(Obstacle Means):

Fig. 1 shows a first embodiment of the present invention. The number "13" is a globe of a metallic magnetic matter, a plurality of which are placed in the clamper 10 so that they can be tumbled to cancel the unbalance of the disk 1. The number "13a" shows a position of a globe 13 in a high- or low-speed rotation, and the number "13b" shows a position of the globe 13 at a stop. The number "27" is a magnet, of which the magnetized face 28 is magnetized in dipole, and the disk 1 is interposed between the magnet 27 and the turn table 9 by forming a magnetic path toward the yoke 11 and thus sucking the yoke 11. The number "35" is a rib as provided in the outer periphery of the magnet 27, and is a obstacle means to prevent the magnetic globes 13 from directly being adsorbed by the magnet 27. The number "24" shows magnetic flux as leaked from the magnet 27.

As to the first embodiment of the present invention with the above constitution, explanations are made about what mechanism is made when the disk 1 is rotated at a high speed or when the number of rotations is rapidly shifted. As is shown in Fig. 6, if the disk 1 exhibiting

unbalance during the high-speed rotation such as data reading is rotated, the centrifugal force 19 from the swinging-rotation center operates upon the globes 13, whereby the globes 13 are pressed onto the tumbling face 20 to move while tumbling, and then assembles in a direction opposite to the unbalance direction of the disk 1 to stop where balanced with the unbalance force, and then rotates in one body with the clamper 10, whereby the unbalance of the disk 1 is canceled.

On the other hand, when the number of rotations is rapidly reduced from the high speed, the magnetic globes 13 collide at a fast speed from the tumbling face 20 toward the rib 35 as provided in the vicinity of the outer periphery of the magnet 27. However, the impact to the rib 35 and the unnecessary noises are largely lessened when compared with the case where the magnetic globes 13 are directly adsorbed by the outer periphery of the magnet. Because the impact is largely lessened when compared with the case of the direct adsorption of the magnetic globes 13 by the magnet 27, error-inducing factors such as servo slipping can largely be reduced. Furthermore, the magnetic globes 13 are adsorbed in a position apart from the outer periphery of the magnet 27 by the thickness of the rib 35 existing therebetween, so the magnetic globes 13 are more difficult to magnetize than the case where they are directly adsorbed by the outer periphery of the magnet 27.

(Globe-Moving Groove):

Figs. 2 and 3 show a second embodiment of the present invention.

Fig. 2 is a detailed section of a balancer, and Fig. 3 is a section of the inside of the clamper 10 as viewed from upward. The number "37" is a globe-moving groove to guide the movement of the globes 13 when the rotation of the disk 1 is rapidly shifted from the high speed to the low

speed or from the low speed to the high speed, which groove is made in the lower face of the clamper 10. The globe-moving groove 37 runs from the inner peripheral side to the outer peripheral side in the form of a vortex or spiral, and further, along a tangent direction of the outer periphery of the magnet 27 on the inner peripheral side and along a tangent direction of the inner periphery of the tumbling face 20 on the outer peripheral side.

As to the second embodiment of the present invention with the above constitution, when the disk 1 is rotated at a high speed, the globes 13 are floated by the function of the outermost slope 38 of the globe-moving groove 37 and rotates in one body with the clamper 10 while being pressed onto the tumbling face 20 (left side of Fig. 2). When the rotation of the disk 1 is rapidly shifted from the high speed to the standard speed, the globes 13 attempt to continue rotating along the tumbling face 20 due to inertia of their rotation, but the globes 13 enter the globe-moving groove 37 due to their own weights. Then, the globes 13 are induced into the globe-moving groove 37 to rapidly approach the inner peripheral side along this groove, and are then adsorbed by the magnet 27 (right side of Fig. 2).

In this case, in comparison with a flat moving face in the conventional apparatus of Fig. 5, the globes 13 can rapidly move, and the timing of the collision of the globes 13 with the magnet 27 can be set to earlier than the initiation of the audio data reading, so errors due to the impact during the adsorption can be prevented from occurring.

Furthermore, in the spinning up, the globes 13 move along the globe-moving groove 37 to collide in a tangent direction of the tumbling face 20. Therefore, in comparison with the collision in a radial direction

like in other cases, the impact can be suppressed to a much less one, and the induction of errors due to the impact in the spinning up can be suppressed.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side section of the vicinity of an spindle motor of a disk apparatus according to an embodiment of the present invention.

Fig. 2 is a side section of the vicinity of an spindle motor of a disk apparatus according to another embodiment of the present invention.

Fig. 3 is a horizontal section of an arrangement structure of a globe-moving groove.

Fig. 4 is a perspective of a conventional disk apparatus.

Fig. 5 is a side section of the vicinity of an spindle motor of the conventional disk apparatus having a balancer.

Fig. 6 is a horizontal section showing the function of the balancer in the conventional disk apparatus.

INDUSTRIAL APPLICATION

As is mentioned above, as to the disk apparatus according to the present invention, the impact due to the collision of the magnetic globes during the rapid shifting of the number of rotations can be reduced, so errors, such as read errors and spinning-up time over, can be prevented from occurring. And further, the magnetic globes have a structure difficult to be magnetized by the magnet, so they stably move to cancel the unbalance, thereby enabling the realization of a disk apparatus which can stably replay and record data.

CLAIMS

1. A disk apparatus, comprising: a balancer, which is set to rotate in one body with a fitted disk and has a hollow ring-shaped part containing a magnetic matter; and a magnetic-field-generating means for holding the magnetic matter by suction;

wherein: the magnetic-field-generating means includes a magnet; and

the outer periphery of the magnet is an inner wall of the hollow ring-shaped part;

with the disk apparatus further comprising an obstacle means for preventing the magnetic matter from directly contacting the magnet.

2. A disk apparatus, comprising: a balancer, which is set to rotate in one body with a fitted disk and has a hollow ring-shaped part containing a magnetic matter; and a magnetic-field-generating means for holding the magnetic matter by suction;

with the disk apparatus further comprising a guide groove for guiding the movement of the magnetic matter in a lower face of the hollow ring-shaped part.

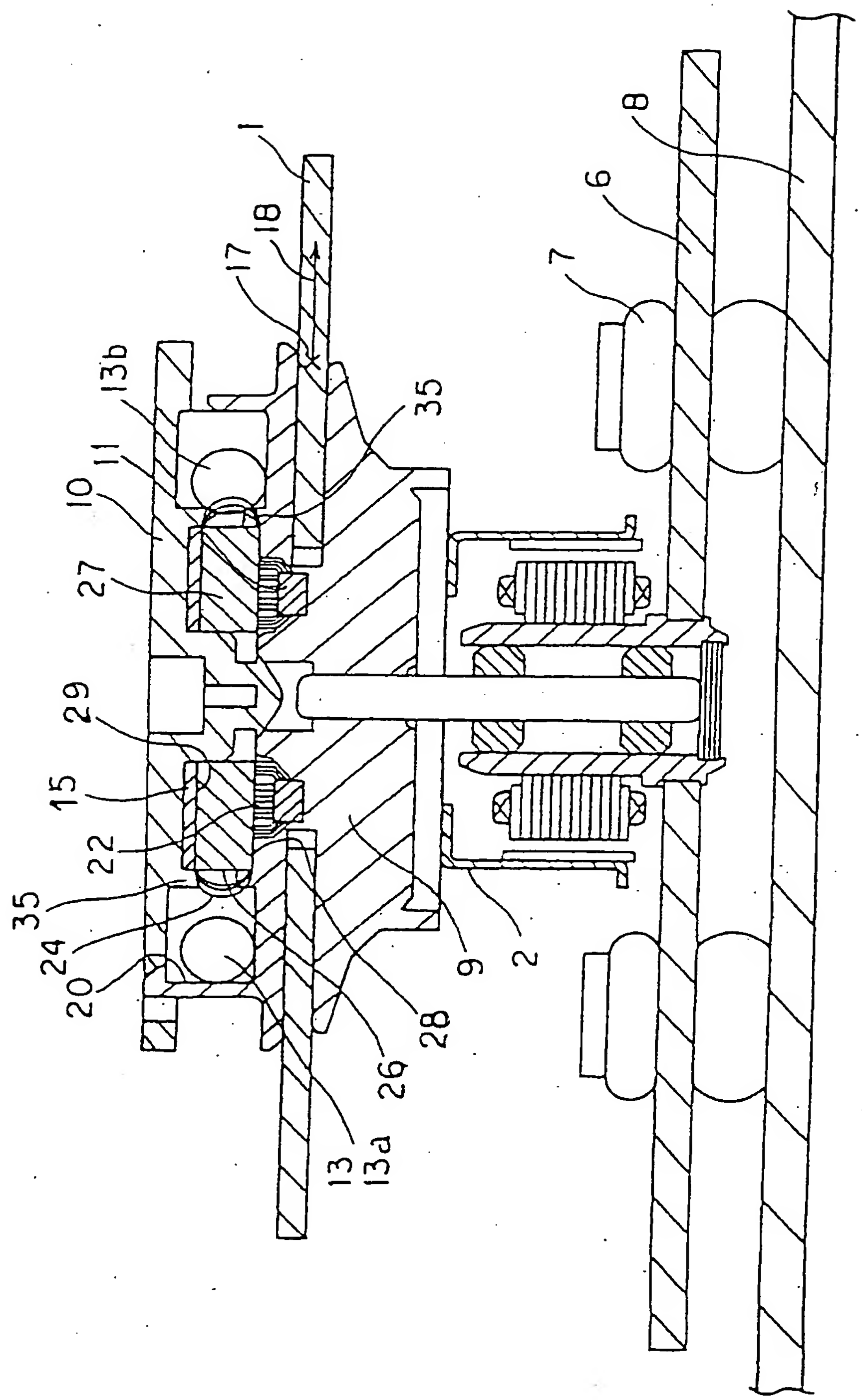


Fig. 1

Fig. 2

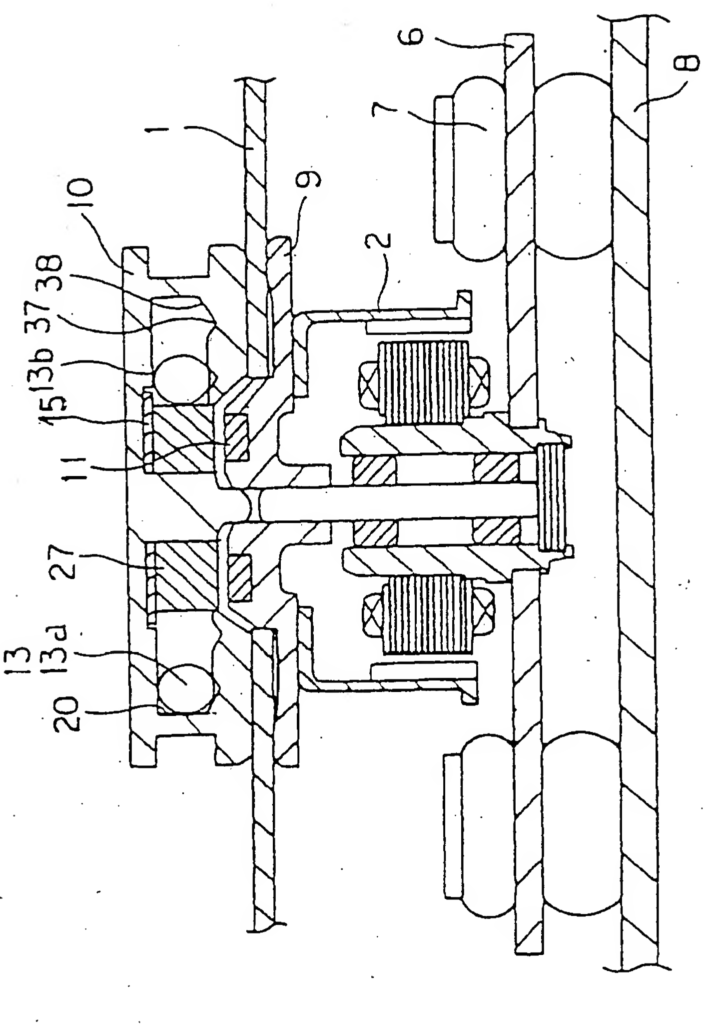


Fig. 3

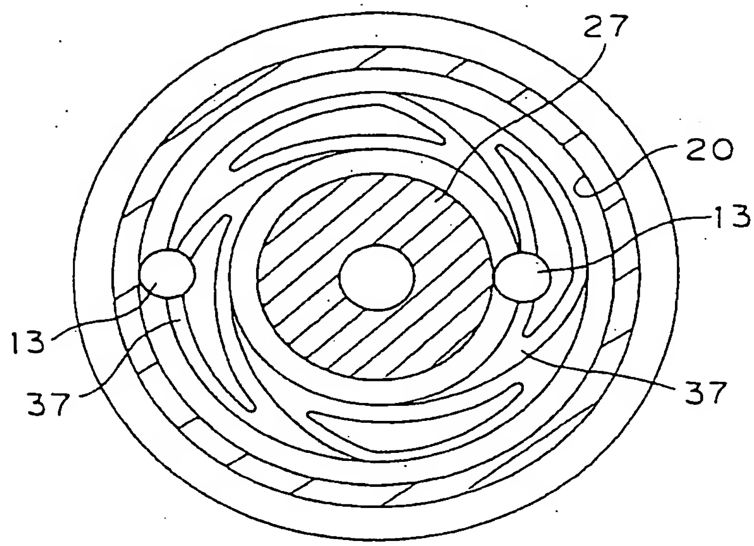
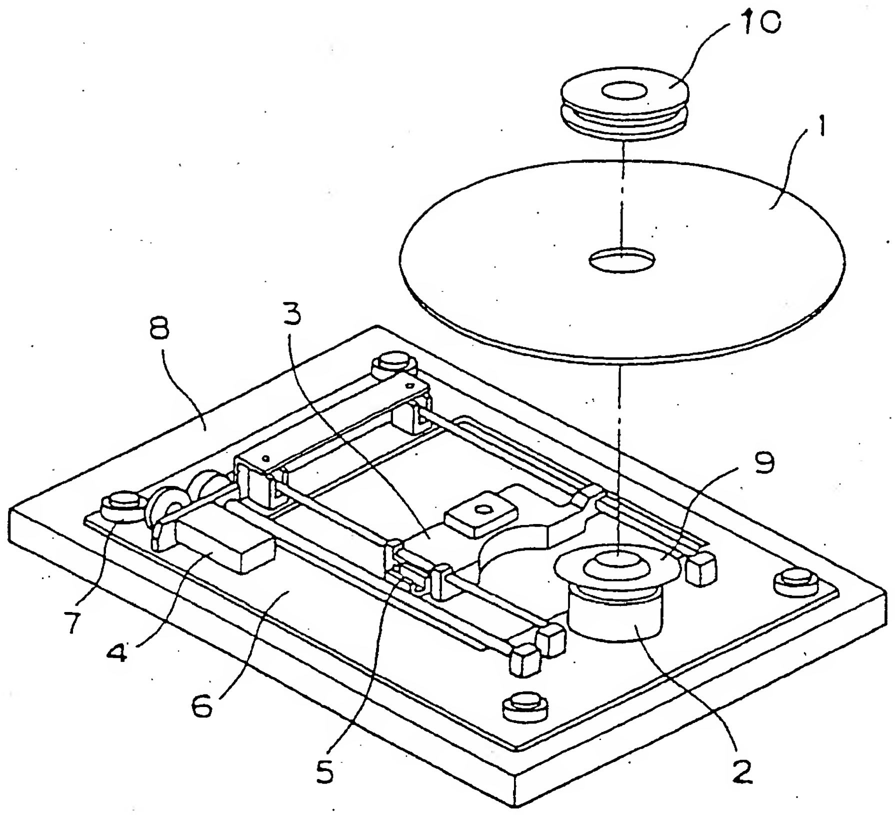


Fig. 4



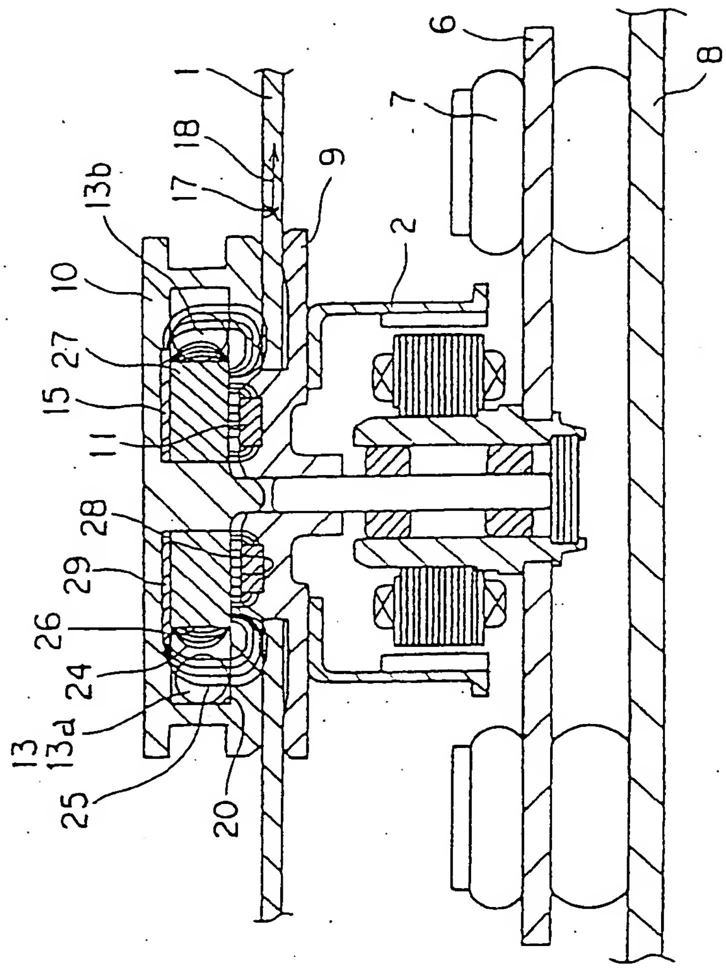
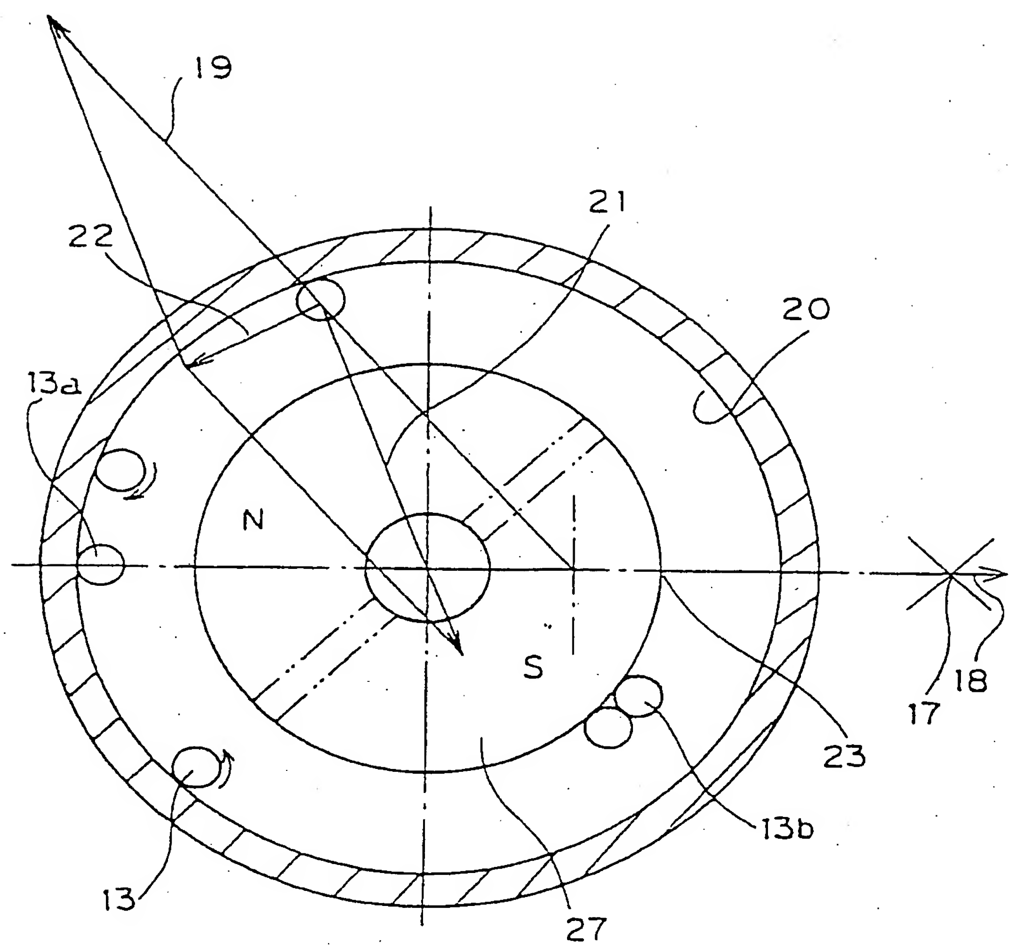


Fig. 5

Fig. 6



INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP 99/03679

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G11B19/20 H02K7/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G11B H02K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Name and mailing address of the ISA	Authorized officer
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International Application No
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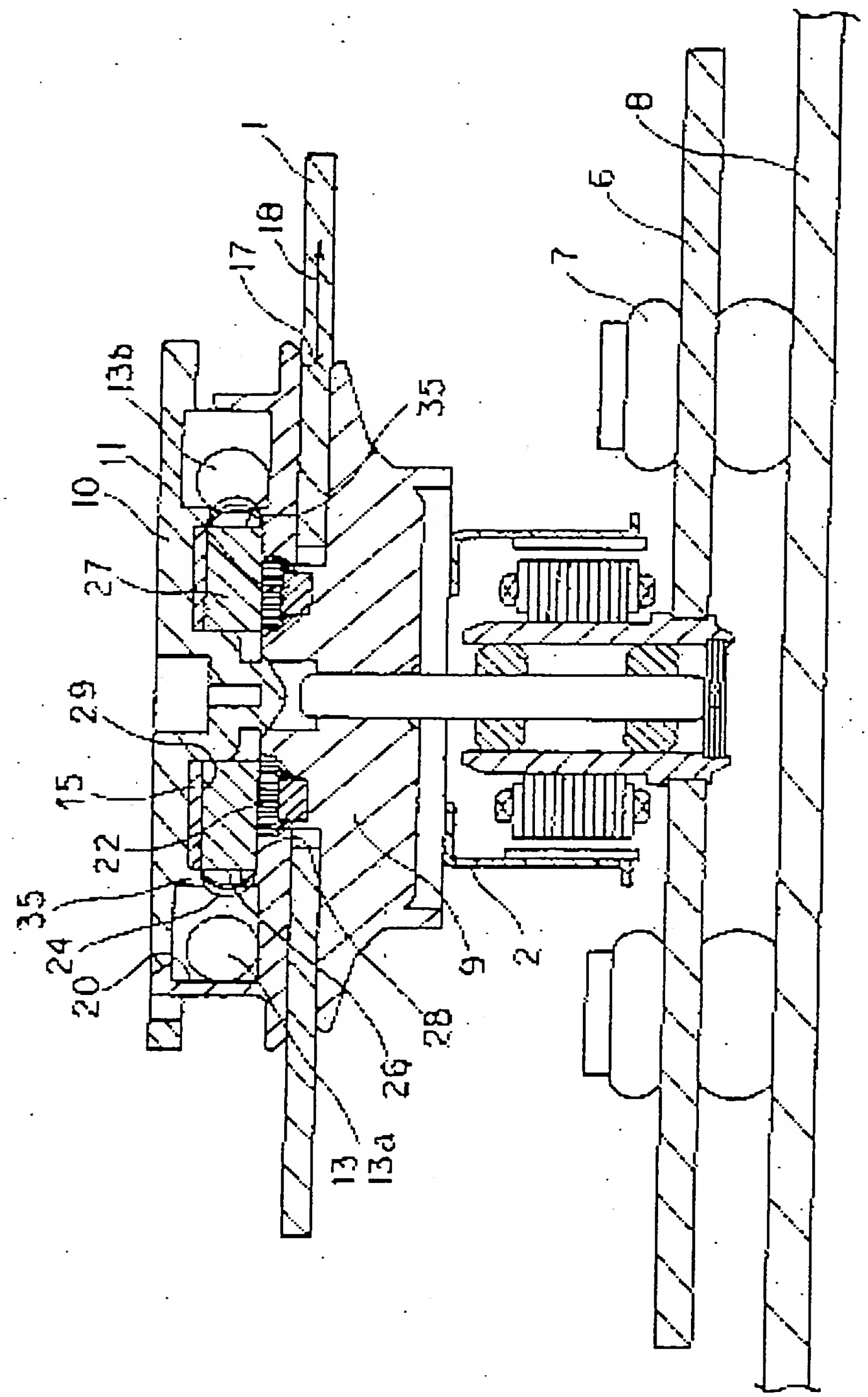


Fig. 1

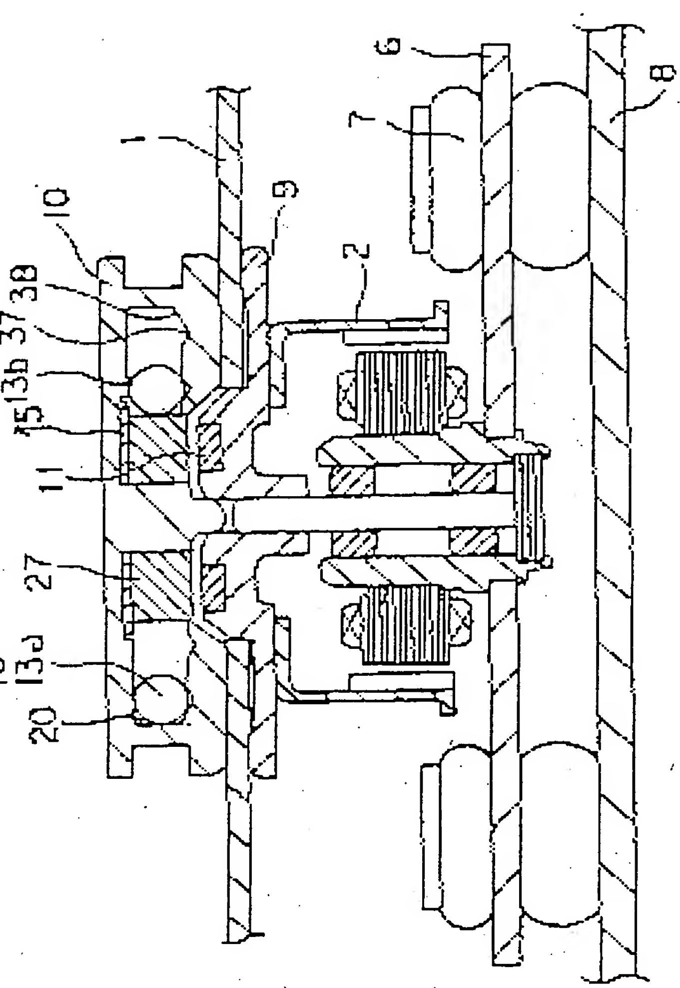


Fig. 2

Fig. 3

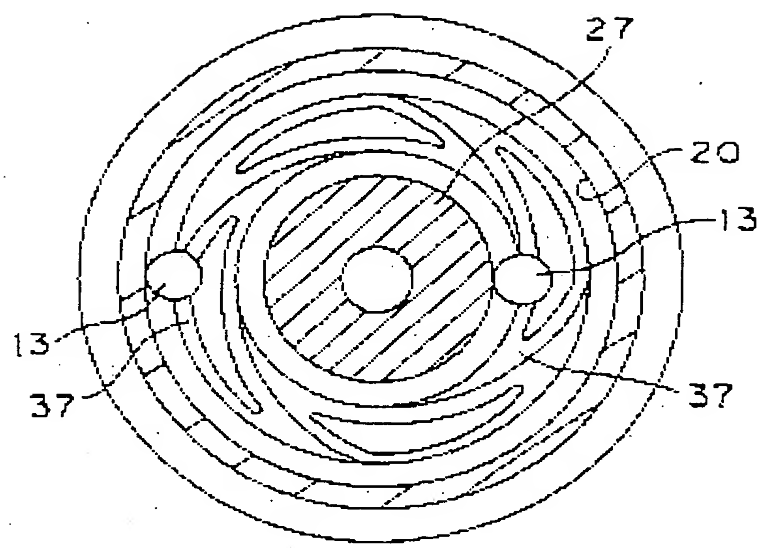
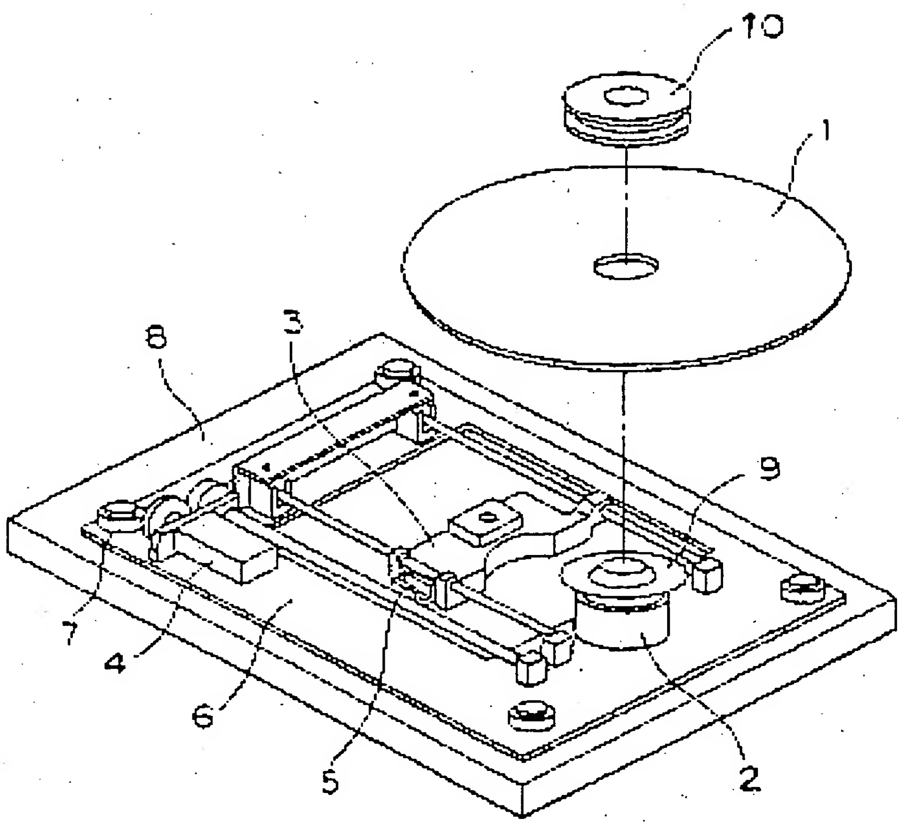


Fig. 4



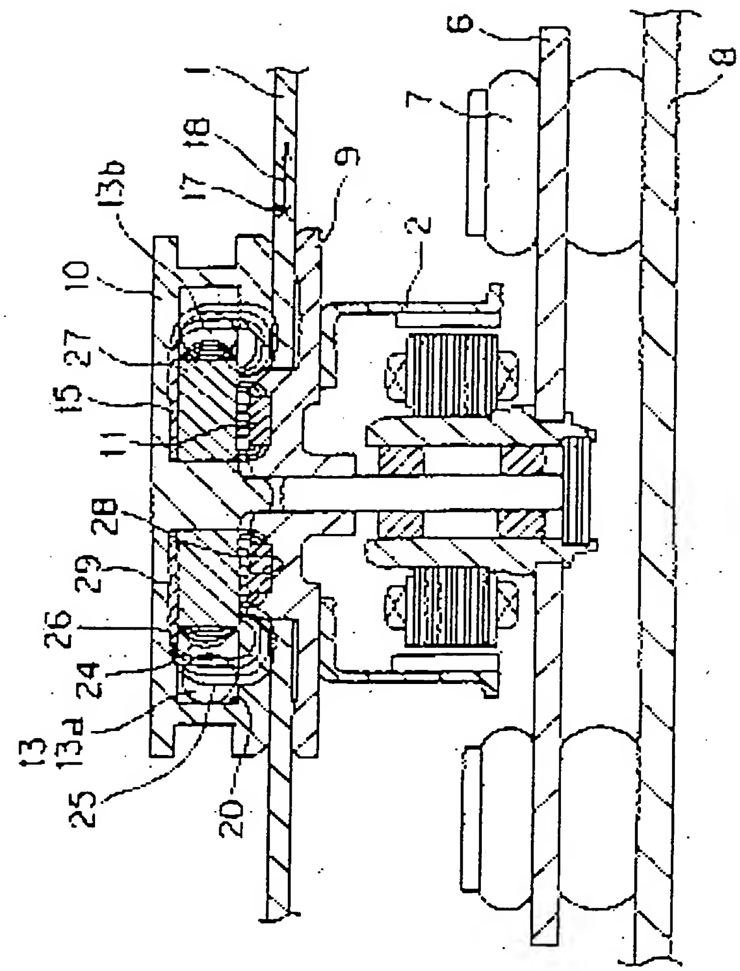


Fig. 5

Fig. 6